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10/624,356	07/21/2003	Aaron Scott Lukas	06336P USA	7682

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EXAMINER

PADGETT, MARIANNE L

ART UNIT	PAPER NUMBER
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1762

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08/08/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/624,356

Applicant(s)

LUKAS ET AL.

Examiner

Marianne L. Padgett

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 6/6/2007, and 5/9/2007 & 2/15/2007.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29,32-35 and 37-73 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s), _____ is/are allowed.
- 6) ☒ Claim(s) 1-29,32-35 and 37-73 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 6/6/7.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

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1. It is noted that SN 10/409,468 has been amended such that it only contains composition claims, thus removing it from consideration under obviousness double patenting.

The independent claims 1, 28, 37-38 & 42 are now all limited to CVD processes, thus removing the rejections of 12/27/2006 based on You et al. (2005/0255710 A1), which performs its depositions by spin coating or casting.

The amendment of 5/9/2007 corrected the noncompliant of 2/15/07 has removed 112, second paragraph problems as described in section 2 of the action mailed 12/27/06, but introduced below discussed problems.

2. Claim 73 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 73 dependent on claim 8 is vague and indefinite since while the option of laser from the Markush group of claim 8 is further described, the dependent claim 73 does not positive the claim that laser is chosen, such that it is uncertain whether the limitations of this dependent claim are being actually claimed, or if they are optional, as in unchosen alternatives.

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner

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to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1-27, 37-45, 53-66 & 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grill et al. (WO 02/11204 A1), in view of Gallagher et al. (6,596,467 B2) or Zampini et al. (EP 1 197 998 A2), as discussed in section 8 of the action mailed 8/16/2006.

It has been noted by applicants in copending case 10/295,568 that the figures in USPN 6312793, also to Grill et al. are the same as those figures that should be with the above applied WO document, it will be so considered.

Grill et al. (WO) has a range of teachings with respect to porosity and its multiphase material, where that Grill et al., who teach the "multiphase material may further contain molecular scale voids" (page 7, line 6-7 of 5th paragraph), teaches this for as-deposited films (note this is may not must), but they also specifically teach "the low dielectric constant multiphase film of the invention can further be heat-treated at a temperature not less than 300°C for at least 0.5 hours to reduce the dielectric constant" (page 7, line 12-14 of 5th paragraph; emphasis added), then further explicitly teach that "During this heat treatment step, molecular fragments derived from the second precursor gas (or gas mixture) containing

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essentially carbon and hydrogen atoms may thermally decompose and may be converted into smaller molecules which are released from the film. Optionally, further development of voids may occur in the film by said process of conversion and release of the molecular fragments. The film density is thus decreased." (Page 7, 6th paragraph; emphasis added). The silicon based phase is shown in figure 2B, where it is noted that the structure as illustrated is substantially free of Si-OH bonds. Grill et al. differs in that the removal step is via thermal annealing, instead of UV post-treatment, but Grill et al. clearly teach the option of reducing dielectric constant and decreasing film density via a posttreatment step of annealing (heat treatment) to remove deposits in the multiphase film that are from the second precursor gas (or gas mixture) which contains mainly C & H atoms.

It is further noted, Grill et al. teaches making a multiphase material to be used as a dielectric via a plasma enhanced chemical vapor deposition (PECVD) technique, where the precursor materials may include a first precursor gas including claimed organosilanes or organosiloxanes (oxidizing agents optionally added), such as tetramethylcyclotetrasiloxane (TMCTS), methylsilanes, etc., plus a second precursor gas consisting essentially of carbon and hydrogen containing molecules, including hydrocarbons, ethers, alcohols, esters, ketones, F-containing hydrocarbons, **norbornadiene** containing compounds, which is bicyclic, norbornane (bicyclic) and, benzene, toluene, xylene, etc. and "and the like", optionally mixed with an inert carrier gas. The teaching of "and the like" with respect to the pore forming second precursor gases is considered to be suggestive to one of ordinary skill of employing derivatives of suggested precursor compounds. Grill et al. particularly teach adjusting plasma conditions so as to minimize dissociation of the second precursor molecules (equivalent of claimed pore-former gas), then provides for a posttreatment heating step, where the resultant multiphase film from this process contains nanometer size pores. In Grill et al., see the abstract; claims 15-41, especially 15, 19-28, and 29, 32-41; page 7 ($K \leq 3.6$, after PECVD heat to develop voids, thus decreased density of film); page 8, end of first paragraph (plasma deposit of TMCTS + norbornadiene = bicyclo-[2.2.1] hepta-2,5-diene (BCHD))

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+ He, with post-treat by heating to reduce K); page 9, (pores of nanometer size, 0.5-200 nanometer diameters) & example 1 (SiCOH film from TMCTS + BCHD + He produces film with $K = 3.13$, after annealing $K = 2.91$); page 10 ($K = 2.81$ after heating); page 11, example 5 (first phase = host matrix \equiv structure-forming phase, has ~5-40 atomic % Si, ~5-45 atomic % C, ~0-50 atomic % O, ~10-55 atomic % H, optionally including F); and page 12 last full paragraph (heat to stabilize, $K \leq 3.2$).

It is noted that while the range of dielectric constants produced by the process of Grill et al. is not identical to the ranges claimed by applicants of $K \leq 2.7$, etc., all of the ranges claimed by applicants are encompassed by those taught by Grill et al. (204), with specific exemplary dielectric constants being very close to applicants' claimed endpoint. While decrease of density after treatment to remove the C & H containing second precursor is taught, no particular percentages of density change after this treatment are given, however it would have been obvious to one of ordinary skill in the art to optimize, via routine experimentation, the properties of the dielectric film produced by the process, where the porosity is produced thereby would have been expected to have densities within the ranges claimed, as the decreasing density is seen to coincide with the trend of decreasing the value of the dielectric constant via the posttreatment process to remove the porogen.

Grill et al. (204) differs from the claims by requiring the use of heating to remove their porogen or pore-forming phase in their multiphasic film, while the present claims require the use of ultraviolet light in a nonoxidizing atmosphere. Note that Grill et al.'s second precursor or porogen include various hydrocarbon compounds or derivatives thereof that are frequently used to solvents, as well as various diene compounds, etc. Also that for Grill et al.'s post treatment to be effective for the taught reduction of dielectric constant and the taught decrease of film density, they teach using temperatures of not less than 300°C for at least 0.5 hours.

Gallagher et al. and Zampini et al., both teach preparation of low dielectric constant porous materials that deposit a mixture of structural forming material and porogen, where the structural forming

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material is at least partially cured, i.e. reacted, before the removal of the porogens, which removal may be via a variety of different processes, with the preferred means being exposure to either heat or UV light to remove the porogen. In Gallagher et al., see the abstract; col. 1, lines 31-44 col. 2, lines 5-31; col. 3, lines 25-30; col. 6, lines 1-col. 7, line 12 for discussion of porogens, particularly noting col. 7, lines 1-12 (porogens = highly branched pathetic esters, poly (aryl esters), poly (ether ketones), polynorbornenes, polyaromatic hydrocarbons, poly perfluorinated hydrocarbons, etc.); col. 7, lines 25-64 removal of porogens, especially lines 31-35 for preferred exposure to heat or UV & lines 51-64 removal by radiation (UV) under inert atmospheres, such as nitrogen or inert gas. In Zampini et al., for analogous disclosures see [0015-22]; [0025]; [0035-38] [0063-65]; [0074-0077], especially 75 & 77 for the preference of removal of porogens via heat or UV exposure, and use of inert atmosphere with the UV. Zampini includes as removable porogens norbornene & adamantane-containing compounds [0064], poly (alkyleneoxide) containing compounds ([0038] & [0063]), hyperbranched polymeric materials [0036], etc. While Zampini et al. or Gallagher et al. are depositing their multiphasic films via solution instead of CVD processes, they are removing porogens from their multiphasic material for the same purpose as Grill et al. (204), where their types of porogens overlap with those of the primary reference, and they teach equivalent use and effect of exposure to heat or to UV in inert (i.e. non-oxidizing) atmosphere, such as nitrogen, for porogen removal. Hence, it would have been obvious to one of ordinary skill in the art to employ UV radiation in nitrogen or other inert atmospheres for the porogen removal in the process of Grill et al. (204), as it would have been expected to be equivalently useful and effective, since in both cases the dielectric structural material is deposited in set before the removal of the porogen such that the porogen's removal would have been expected to be dependent on its composition, not its means of deposition, considering that times for photo reactions are generally shorter than thermal reactions providing a time efficiency advantage, and especially further considering the conventional advantage of radiation/UV processes enabling use of lower temperatures with heat sensitive materials than is frequently

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possible with purely thermal processing. It is also noted that claim 15 before the current amendment would provide to an indication that solution & chemical vapor deposition processes have not been taught to be significantly distinguished by the present application.

While both the secondary references disclose a preference for removal of the porogen via UV light under inert atmosphere (nitrogen or inert gas), and that more than one method of porogen removal may be employed, such as the combination of heat and actinic radiation (includes UV), they do not provide teachings on any specific source of UV radiation to be employed, however it would have been obvious to one of ordinary skill in the art to use available light sources, such as claimed lamps and lasers, that emit UV radiation, where the particular wavelength, hence source of radiation, would have been expected to have been chosen according to the particular porogens to be removed, such that the wavelength emitted would be absorbed by &/or interact with the particular porogen being employed, so as to enable the taught removal. Therefore, choice of wavelengths within particular segments of the UV range as claimed would have been obvious depending on particular porogens employed in the part of the UV spectrum with which they interact so that removal may be affected.

Further note teachings of the secondary references to employ plural porogen removal methods, such as the exemplified combination of the two preferred modes of heat plus UV, although any of the taught removal methods of actinic, IR, microwave, UV, x-ray, gamma ray, alpha particles, neutron beam or electron beam may be considered to have been generally suggested as combinable by the teaching of using one or more methods to remove the porogens, thus obvious to use as an alternative in the Grill et al. (204) teachings.

5. Claims 28-29, 32-35 & 67-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grill et al. (WO 02/11204 A1), in view of Gallagher et al. (6,596,467 B2) or Zampini et al. (EP 1 197 998 A2) as applied to claims 1-27, 37-45, 53-66 & 73 above, and further in view of Albano et al. (2003/0054115 A1), as discussed in section 9 of the action mailed 8/16/2006.

The above combination of section 4 does not teach further treating after the exposing step, which causes the removal of the porogen/pore-forming phase, however Albano et al. (115), who teach that porous dielectric materials can be deposited from spin-on or CVD processes [0021], further disclose UV curing can generate polar species in porous dielectric materials, which can be undesirable in some applications, and "that post-UV treating UV cured porous dielectric materials produces a low dielectric constant, improved modulus material" [0022]. As the above combination applies UV to dielectric porous material analogous to that disclosed by Albano et al., those may be effecting production of polar species as taught including their undesirability for some applications, it would have been obvious to one of ordinary skill in the art to employ post-UV treatment procedures, such as thermal &/or plasma exposure, as suggested in Albano et al. to remove these potentially undesirable species, thus produce porous dielectric material, which can be expected to have improved elastic modulus and dielectric constants consistent with the taught values of about 1.1 to about 3.5 (abstract; [0080-85]).

6. Claims 1-8, 10-15, 22, 25-28, 32-34, 37, 41-45 & 53-73 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-3, 7-14, 16-22 and 25-41 of U.S. patent No. 7,098,149 B2 (previously copending Application No.10/379,466), optionally in view of Rose et al. (6,068,884).

Since the patent it claims are directed to CVD processes which are encompassed in the claims before the amendment of 5/9/2007, there is no basic change in this rejection.

Although the conflicting claims are not identical, they are not patentably distinct from each other because reasons as discussed in sections 5 & 7-8 of action is mailed 5/19/2006 & 9/21/2005, respectively. Furthermore, note that these claims are directed to a deposited film of the same basic structure that may be deposited using identical reagents, which after deposition may be identically treated with ultraviolet radiation, and optionally also heating, where the claim sets differ by the present claims requiring "wherein the composite film is substantially free of Si-OH bonds", however like reagents with undifferentiated

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deposition techniques will inherently produce the same range of deposited results, hence the patented claims encompass the present claim compositions. Alternately, it would've been obvious to one of ordinary skill in the art to deposit the compositions, which may be deposited by chemical vapor deposition techniques, so as to avoid formation of Si-OH bonds, as it is known in the art as discussed by Rose et al. that such functional groups in dielectric materials are undesirable and means of avoiding their formation are known (abstract; figures especially 1, 3 & 4; column 3, line 45-column 4, line 31+ generally; column 5, lines 49-67; column 7, line 43-column 8, line 41, especially lines 10-29). While the low k dielectric films produced by Rose et al. do not discuss porosity, disadvantages of creating Si-OH functionalities would have been expected to be independent of whether the low dielectric constant material was porous or not, hence the desirability of avoiding formation of such bonds would have been independent of the presence of porosity.

7. Claims 1-29, 32, 35, 37-45 & 53-73 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 55-93 of copending Application No. 10/295,568, optionally in view of Rose et al. as discussed above.

The claims in this application are also directed to CVD processing, thus the amendment make not necessitate significant changes with respect to this rejection.

Although the conflicting claims are not identical, they are not patentably distinct from each other because, while options are claimed in some different orders, and independent claims have varied emphases on energy source used with the broader photon source of (295,568) encompassing the UV of the present case, with the exception of the above discussed (section 5) limitation added in the 10/12/2006 amendment, all the same options are present in each set of claims, thus creating obvious variations, as discussed in sections 4 & 6 of the 5/19/2006 & 9/21/2005 rejections, respectively. The limitation of the amendment to present claims is considered inherent &/or obvious for reasons as discussed above

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This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

8. Claims 1-13, 15-16, 25-29, 32- 35, 37-45 & 53-73 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-14, 20-22, 24-27 and 30 of copending Application No. 10/842,503, optionally in view of Rose et al. as discussed above.

These claims of the copending application, as exemplified by claim 30 therein also encompass the amended limitation of CVD process, however claimed in different orders, thus also do not necessitate changes in this rejection.

Although the conflicting claims are not identical, they are not patentably distinct from each other because while various limitations are claimed in different orders, and with varying degrees of emphasis, the process limitations of these claims overlap in their generics and specific requirements, such that they are obvious variations on each other for reasons as discussed in section 9 in the 9/21/2005 action & above in section 5.

9. Claims 1-29, 32- 35, 37-45 & 53-72, or 1-13, 15-29, 32-35, 37-45 & 53-73 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-47 & 50-54 of copending Application No. 11/228,223 (= 2006/0078676 A1), respectively, optionally in view of Rose et al.

Although the conflicting claims are not identical, they are not patentably distinct from each other because again, the various limitations in the two applications are claimed in different orders with different emphasizes and phraseology, but overlapping generic and specific requirements, creating obvious variations wherefore for 10/409,468 reasons as discussed in section 11 of the 9/21/2005 action & in section 5 above remain relevant. For SN 11/228,223 noted porogens claimed corresponding to the newly added porogen limiting limitations of claims 54-72 of the present case, which read on the more specific

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compounds previously claimed, specific matrix material as claimed designated in claimed three of the copending case & methods of posttreatment in claims 50-53 that are inclusive of photon energy having wavelengths in the UV & removal of all porogens, such that the reasoning applied to the (468) case also applies to (223). Also note that for (223), while all specific parameters are not discussed, reasons for obviousness of routine experimentation for optimization of such parameters have been previously discussed in the case & may be found below in section 11, and are equally obvious with respect to analogous processes & compensations claimed in this application.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

10. Applicant's arguments with respect to claims 1-29, 32-35, 37-73 have been considered but are moot in view of the new ground(s) of rejection.

It is noted that claim 42 was not rejected under prior art of you et al. in the last rejection, and amendments thereto did not necessitate the new art rejection thereover, as it already related to CVD, hence this rejection is not made final.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marianne L. Padgett whose telephone number is (571) 272-1425. The examiner can normally be reached on M-F from about 8:30 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

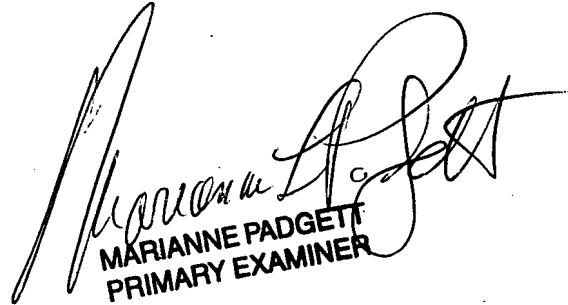
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MLP/dictation software

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MARIANNE PADGETT
PRIMARY EXAMINER